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Performance and Evaluation Report

Final Report

STScI Grant No: NAG5-1907

Reporting Period: March 1, 1992 - August 31, 1994

- I. PRINCIPAL INVESTIGATOR:** William B. Sparks
- II. INSTITUTION:** Space Telescope Science Institute
- III. PROJECT TITLE:** Dusty Emission Filaments in Elliptical Galaxies
- IV. SUMMARY OF PROJECT ACTIVITIES:**

1. Brief description of the primary objectives and scope of the project:

The theory of cooling flows to explain X-ray excesses at the centers of galaxies and clusters of galaxies has been challenged by Sparks, Macchetto and Golombek (1989). They proposed that electron thermal conduction and mergers of galaxies together offer a more satisfactory explanation of the observations, an explanation which by contrast to cooling-flows is able to quantitatively yield correct line emission fluxes, X-ray spectra, infra-red and dust properties and the lack of observed cooling remnants. To test the conduction theory directly, the prediction was made that X-ray morphology should resemble closely optical line emission morphology and ROSAT HRI time to observe a classical candidate was awarded. ROSAT HRI observations of duration 16.3 KSec were obtained early 1993 of the central cD galaxy in the Centaurus cluster of galaxies, NGC4696. The optical emission system in this object is extremely dusty, and is strongly suggestive of a merger event. We wished to establish whether the X-ray gas "knows" about the optically emitting material.

2. Brief description of the findings:

The X-ray image shows a compact one-armed spiral very similar in scale and location to the optical one-armed emission spiral, as we predicted in the conduction model. The peak of the X-ray emission is within the

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optical emission filament system and not at the nucleus of the galaxy. This clearly demonstrates that there is a connection between the optical HII emission region and the hot coronal X-ray emitting gas. Understanding the nature of the connection will lead to knowledge of the relevant physical processes in early-type galaxy atmospheres and clusters of galaxies, and hence to an assessment of whether there is validity in either the cooling-flow model, the merger alternative or perhaps some presently unforeseen process.

3. Name and date (or anticipated date) of the publication of results:

publications:

The results are published in Sparks, Jedrzejewski and Macchetto (1994) and may form the basis for continued observational and theoretical work on this galaxy and others in which it is thought that similar physical processes operate.

The findings were also presented at the Aspen Summer School on galaxies and clusters. W.B. Sparks, R.I. Jedrzejewski, F. Macchetto, 1994, p389, AIP Conference Proceedings 313, The Soft X-Ray Cosmos, ROSAT Science Symposium, College Park, MD. 1993. Eds. Schlegel, R. Petre.

4. Suggestions and additional comments: None.

Signature of Principal Investigator:

Date:

W.B. Sparks
20/6/95